

TOPOGRAPHIC MAP SKILLS - Part II

Purpose:

The purpose of this exercise is to demonstrate the usefulness of topographic maps and to examine the topography of the Yucca Mountain site by using a U.S. Geological Survey 7-1/2-minute topographic map. By participating in the exercise, the student will acquire a detailed knowledge of the Yucca Mountain site and an understanding of the size and depth of the potential repository. The student will also use prominent features on the map to aid him/her in thinking about guidelines for a repository published in the *Code of Federal Regulations (10 CFR part 60)* concerning erosion, hydrology, population density and distribution, and site ownership and control.

Concepts:

1. A topographic map is the projection of a landscape onto a piece of paper showing detailed surface features of the Earth such as elevation and slope and the presence of water.
2. Given the coordinates of a point on a topographic map, points of orientation such as map borders and grid ticks can be used to locate that point on the map.
3. A topographic map can be used to produce a profile of the topography between two points.
4. A topographic map includes the placement of existing buildings and information regarding general ownership of the land.
5. A topographic map can be used to develop working hypotheses regarding land use.

Duration of Lesson:

Five 50-minute class periods

Objectives:

As a result of participation in this lesson, the learner will be able to:

1. interpret topographic map scale and symbols;
2. draw a topographic profile; and
3. synthesize information from the topographic map and *The General Guidelines for the Recommendation of Sites for the Nuclear Waste Repositories* to make judgments relating to repository siting.

Skills:

Analyzing, calculating, constructing topographic profiles, decision making, determining contour intervals, finding scale, graphing, using longitude and latitude, plotting map coordinates, synthesizing

Vocabulary:

Accessible environment, aquifer, brine, dike, dissolution, erosion, evapotranspiration, exhumation, fault, flux, fold, geohydrology, geomorphic, hydraulic, hydraulic gradient, Quarternary Period, radionuclide, shear, sill, stratigraphic

Materials:

Activity Sheets

Topography of the Yucca Mountain Site, p. 219

Considerations for Siting the High Level Nuclear Waste Repository, p. 233

Other

U.S. Geological Survey topographic map (7-1/2-minute version) Busted Butte, Nevada
Quadrangle

Engineers scale with divisions of 10 through 60 per inch (available from drafting or
mechanical drawing classes) or the paper scale

Pencil

Graph paper

Plain paper

Blue pencil

Repository shape cut out

Optional

Federal Register, Thursday, December 6, 1984 (10CFR Part 960), Nuclear Waste Policy
Act of 1982; *Guidelines for the Recommendation of Sites for the Nuclear Waste
Repositories; Final Siting Guidelines* (order free of charge from the OCRWM National
Information Center, 1-800-225-6972; within Washington, DC, 202-488-6720)

Suggested Procedure:

1. As a reading review have students complete the first part of *Topography of the Yucca Mountain Site, Reviewing Map Skills*. Discuss student answers to ensure that they are prepared to continue with *Part A: Locating a Point on a Topographic Map* and *Part B: Drawing a Topographic Profile*.
2. *Part A: Locating a Point on a Topographic Map* will take approximately one class period to complete. Advanced students may be able to follow directions and complete this activity independently.
It may be necessary to work through locating point 1, step by step, with students who have not been exposed to these map skills before. An overhead projector and transparencies of the activity sheets and map would be helpful. Laminating the map so that magic markers can be used and erased after every demonstration may be an alternative to using overhead projection. After locating point 1 as a group, students should be able to follow the same procedure to locate point 2 on their own.
3. *Part B: Drawing a Topographic Profile* will also take approximately one class period to complete. Again, advanced students may be able to follow directions and complete this activity independently. Students may need to share available topographic maps in groups, but have each student produce his/her own profile. If necessary, work through this activity step by step with students. Encourage students to accurately record the position of contour lines and their elevation.

4. In order to complete *Considerations for Siting the High-Level Nuclear Waste Repository* students will need to have their completed profiles. Since this activity is very long, it is suggested that it be completed in separate parts.
5. It may be helpful to read the excerpts from *General Guidelines for the Recommendation of Sites for the Nuclear Waste Repositories* for each section as a group. (These are included as part of the exercise, or students can use the original document.) Discuss each condition to ensure that students understand the terminology. Give students an opportunity to work through the questions following each excerpt in small groups. When each group is finished, discuss answers. Students should realize that they are following a very similar, yet simplified, procedure to that used by geologists who are actually involved in site characterization studies at Yucca Mountain.
6. *Erosion* should take one 50-minute class period to complete. *Ground water* will take two class periods to complete. (Only one if students are able to complete part for homework.) During class discussion, bring students' attention to the fact that they drew the lines representing the water tables on their profiles based on well J-12. Relate drawing this line to the nature of scientific understanding as discussed in the course introduction, and the process of doing science. Be sure students understand that scientists sometimes make assumptions that they cannot really prove, as a starting point or a working hypothesis.
7. *Population Density and Distribution* and *Site Ownership and Control* can be completed in one class period. The pamphlet *Topographic Map Symbols* available from the U. S. Department of the Interior, Geologic Survey (see Background Notes) will help students answer questions in these sections.
8. Metric equivalents have not been provided for this lesson because the topographic maps available through the U.S. Geological Society (USGS) are not metric.

Teacher Evaluation of Learner Performance:

Student participation in class discussions and completion of the activities in Part II of this lesson will indicate understanding.

Additional Enrichment:

Have students create their own topographic map using what they have learned in the Reading Lesson *Topographic Map Skills* and the activities from Parts I and II. They should include the following details on their maps.

Scale: 1: 24,000 (English or Metric units)

Size: 7-1/2 minutes x 7-1/2 minutes

Latitude: Pick your own

Longitude: Pick your own

Magnetic Declination: 12 °

Terrain: Use appropriate symbols to show mountains, depressions, steep slopes, gentle slopes, flat areas, and water.

Color and Symbols: Use the appropriate color and symbols to illustrate property ownership and control and population density and distribution.

Cross Ticks: Place them and label them for latitude and longitude.

Map Title: Make up your own fictional location.

Date: Date the map was created

Bar Scale: Create a bar scale relating the map scale to the actual area of the map.

Contour Lines: Create, indicate, and use the contour interval to show terrain.

After students have created their maps, have them consider *Erosion, Groundwater, Population Density and Distribution* and *Site Ownership and Control* to site a high-level waste repository somewhere on their map. Students should be prepared to defend their choice with evidence based in the *General Guidelines for the Recommendation of Sites for the Nuclear Waste Repositories*.

If time permits, it may be interesting to give students an opportunity to create and role play a *Potentially Adverse Condition* relating to *Site Ownership and Control*. Students may choose to be private landowners, representatives for Indian tribes, representatives for the affected State or DOE officials. As part of the role play, they should either resolve the dispute or decide to consider another site for characterization. Decisions and conclusions for each group should be made based on discoveries made during participation in this curriculum.